

18236(M)

B. Tech 6th Semester Examination

Digital Signal Processing (CBS)

EC-604

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt all questions. Question no. 5 will be compulsory.

1. Attempt any one part of the following:

- (a) What are the basic elements of DSP systems? Write the limitations of it. Also define discrete time signals and classify them.
- (b) Define z-transform and region of convergence. Establish the relation between DFT and z-transform. Find z-transform and ROC of the following sequence

$$x[n] = \frac{1}{2}\delta(n+1) + 5\left(\frac{1}{2}\right)^{-n} u(-n) + u(-n-1) \quad (10)$$

2. Attempt any one part of the following:

- (a) Explain following
 - (i) Given an FFT program to find the N-point DFT of a sequence, how may this program be used to find the inverse DFT?
 - (ii) State and prove the "circular convolution" property of DFT.

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- (b) DFT of a sequence $x(n)$ is given by:

$$X(k) = \{6, 0, -2, 0\}$$

- (i) Determine $x(n)$
- (ii) Plot $x_1(n)$ if $X_1(k)$ is $X(k)e^{-j2\pi k/2}$
- (iii) Determine circular autocorrelation of $x(n)$ using DFT and IDFT only. (10)

3. Attempt any one part of the following:

- (a) Determine and draw the cascade and parallel realization for the system described by the system function:

$$H(z) = \frac{10\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{2}{8}z^{-1}\right)\left(1 - 2z^{-1}\right)}{\left(1 - \frac{3}{4}z^{-1}\right)\left(1 - \frac{1}{8}z^{-1}\right)\left(1 - z^{-1} + \frac{1}{2}z^{-2}\right)}$$

- (b) A digital filter has following frequency specification:
Passband frequency = 0.2π

Stopband frequency = 0.3π

What are the corresponding specifications for passband and stopband frequencies in analog domain if

- (i) Impulse invariance technique is used for designing.
- (ii) Bilinear transformation is used for designing. (10)

4. Attempt any one part of the following:

- (a) What is the need for spectral estimation? How can the energy density spectrum be determined? What do you mean by a multi-rate digital signal processing? Enumerate areas of application of multi-rate digital signal processing.

[P.T.O.]

- (b) Why DSP hardware/ algorithms are becoming popular in signal processing? Explain the DSP subsystem used in radar system. (10)

5. Attempt any five part of the following. This part is compulsory. Write the short notes on the following:

- (a) Speech synthesizer.
- (b) Adaptive filter.
- (c) Decimator and decimation filter.
- (d) Interpolator and interpolation filter.
- (e) All properties of z-transform.
- (f) Poly phase digital filter structure. (5×4=20)